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How Are Tourists Affected By Offshore Wind Turbines? A Case Study Of The First U.S. Offshore Wind Farm

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1. INTRODUCTION

The wind power sector has experienced exponential growth in the United States in recent years. By 2018, total wind capacity reached 96.5GW, a four-fold increase within only a decade. An average yearly growth rate of 18% in the past decade propelled the country to become the second-largest wind power market in the world, accounting for 16% of global capacity (American Wind Energy Association, 2018).

Although the growth has been driven by onshore wind power capacity alone, the first commercial offshore wind farm was constructed in the Atlantic Ocean, off the coast of Block Island, Rhode Island in 2016. The five-turbine, 30 MW project is 3.8 miles away from the shore and started operating in December 2016. The farm provides most of Block Island's energy demand, which had historically depended on diesel generators. This farm paved the way for proposals of several other offshore wind projects with a combined potential capacity of over 25,000 MW throughout the country. As of June 2018, offshore wind farms with a cumulative capacity of 1,900 MW are approved to commence operations by 2033, with the majority of the share being accounted for by three states: Massachusetts (800 MW), Rhode Island (400 MW), and Connecticut (200 MW) (Beiter et al., 2018).

The considerable time lag between onshore (1980) and offshore (2016) wind power in the United States can be attributed to two main factors: substantially higher costs of offshore wind generation and local opposition (Lutzeyer et al., 2018). One of the major sources of the opposition by local communities stems from the perceived disruption of ocean views by turbines (Firestone et al., 2018). For instance, developer Cape Wind's plan to erect over 100 offshore wind turbines in Nantucket Sound, Massachusetts, was toppled in part due to the opposition by property owners concerned about their view of the ocean (Bragg, 2018).

The purpose of this paper is to examine the impact of offshore wind turbines on tourists' preferences, while they participate in a suite of recreational activities (sightseeing, fishing, boating, beach visitation, and bird or whale watching). We look into how (i) prior knowledge and (ii) the sight of the turbines affect the revenue generated from tourism. The relationship between tourist activities and offshore turbines has not yet been studied in the context of the establishment of an actual offshore wind farm in the US. We contribute to the literature by exploring how an offshore wind farm affects tourists' preferences for the type of recreational activities performed. Specifically, we analyze the farm's impact on the respondents' willingness to pay (WTP) for these activities in two scenarios: at locations with a view, and without a view of the wind farm. By examining the impact of having seen the turbines on WTP, we also test whether the tourists at Block Island consider the wind farm to be a visual disamenity, a result which will provide some insight into future offshore wind developments in the US.

To meet these objectives, we design an original survey within the context of the Block Island Wind Farm. The survey asks about recreational activities, trips to Block Island, and a broad range of socioeconomic characteristics. The sample consists of 263 people who have been to Block Island at least once in the years 2013 – 2018.

The main focus of the survey is to analyze the impact of the knowledge and sight of the Block Island wind farm on respondents' WTP for choice activities and locations. Across recreational activities, we find that 46-56% of the respondents are indifferent to turbine presence; that is, they are unwilling to pay anything for their choice. Though there is heterogeneity in WTP by activity, the average WTP is positive across all activities.

Following the contingent valuation framework, we estimate multiple regression models to understand the determinants of WTP. Our results indicate that respondents with prior knowledge of the turbines are willing to pay $34 more, on average, for beach locations with a view of the turbines. We find that having seen the turbines in person during the trip has a positive impact on the WTP for fishing and boating, with respondents willing to pay on average, $9.47 more for fishing locations and $20.91 for boating routes with a view of the turbines. This result suggests that the turbines are visually pleasing to people engaged in fishing and boating activities at Block Island, a finding that is contrary to the conclusions of Ladenburg & Dubgaard, (2009). We also find limited evidence of differences in WTP by partisanship: there was no difference in the WTP between Republicans and Democrats for any activity. Independents, however, are willing to pay less for boating and bird/whale watching locations that have a view of the turbines. Socio-economic factors have a weak impact on the WTP, while environmental attitudes have no association with the respondents' WTP for choice activities at locations with a view of the turbines.

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2. BACKGROUND AND LITERATURE REVIEW

One of the most extensively studied concerns regarding wind turbines is the visual disamenity arising from their existence.[1] Studies in Europe have found that the magnitude of disamenity is large but decreases with distance (Bishop & Miller, 2007; Ladenburg, 2009; Ladenburg & Dubgaard, 2007). Within the U.S., while both coastal residents and tourists have exhibited a preference for wind farms to be located at least 4 – 9 miles off the shore (Krueger et al., 2011a; Landry et al., 2012b; Lilley et al., 2010b), they have shown considerable support for smaller scale projects (25 – 30 MW) up to distances as close as 3 miles (Bates & Firestone, 2015; Firestone, et al., 2018). In a similar vein, our study attempts to analyze the perceptions of tourists engaged in several recreational activities around the small scale offshore wind project at Block Island.

The impact of wind farms on tourism and recreational activities has also been examined in the literature. A major concern is whether or not the presence of offshore turbines would induce people to switch to a recreational location from where the turbines are not visible. Ladenburg, (2010) and Ladenburg & Dubgaard (2009) find that this negative impact was stronger for frequent users of the coastal areas, specifically anglers and boaters. Studies also find that the probability of choosing a beach for recreation decreased if a wind farm is located close to the coast, but this effect dies out with distance (Landry et al., 2012b; Lilley et al., 2010b; Westerberg et al., 2013).

However, few studies have been conducted in the United States around an actual establishment of an offshore wind farm (Ladenburg, 2010). For Block Island, in particular, Tenbrink & Dalton (2018) find that the wind farm has led to an increase in recreational fishing around the turbines, though that came at the price of commercial fishing being crowded out. Carr-Harris & Lang (2019) report that the construction of the wind farm had a positive impact on tourism at Block Island since it led to an increase in revenues from AirBnB properties on the island. Our study will, therefore, attempt to fill the gap in the literature related to recreational activities and offshore wind developments by providing the first

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[1] While the focus of this paper is offshore wind, concerns about disamenities of onshore wind turbines have been studied extensively (Gibbons, 2015; Hoen et al., 2011; Lang et al., 2014).

estimates of tourists' WTP for different recreational activities in the presence of the turbines.

Block Island is an ideal location to examine the impact of wind turbines on recreational decisions. Tourism plays an essential role in the island's economy. More than half a million tourists visited the island in 2012, contributing to 247 million USD in tourism expenditures (Norton, 2012). Therefore, any policy change that affects the island's recreational activities and the tourism industry, in general, may have a substantial economic impact. If the wind farm located off its coast is perceived as a disamenity, recreational users may substitute their trips to the neighboring islands of Nantucket and Martha's Vineyard, other popular tourist destinations in the region. There is also the possibility of recreational users switching from one activity to another if they find their experience affected by the turbines' presence.

The Block Island offshore wind farm, therefore, presents a unique opportunity to gauge public preference and perception of a wind farm, especially given that it is the first of its kind to be established within the United States. This study complements recent studies related to Block Island offshore energy development. The literature has found an immense backing for the Block Island wind farm, which has been attributed to several reasons. First, there is general support on the part of coastal residents in Rhode Island and Block Island towards wind power and clean energy (Firestone, et al., 2018). Second, Block Island residents hold consumptive beliefs of the ocean, viewing it as a source of food, energy, and commerce (Bidwell, 2017). Third, the state residents trust their government (Firestone et al., 2020), and the wind farm development process featured extensive engagement of stakeholders in the decision-making process (Dwyer & Bidwell, 2019).

3. METHODOLOGY AND DATA

3.1 Survey Design

We investigate the impact of the wind turbines on recreational choices using a contingent valuation framework. A stated preference survey was designed and refined through two focus groups of five participants each. Focus group participants were paid $40 for a two-hour session, which included completion of the survey, followed by an extensive feedback discussion. The final survey was advertised as "Survey on recreational activities on Block Island" to discourage respondents with pro-renewable energy attitudes from self-selecting into the survey. The survey was disseminated to respondents using a Qualtrics panel[2] in August 2018.

There were three participant eligibility criteria. First, respondents must be 18 years of age and above who reside in the states of California, Connecticut, Florida, Maine, Maryland, Massachusetts, Michigan, New Jersey, New York, Pennsylvania, and Rhode Island. These states were selected as per the survey conducted by Tyrrell, (2000)[3], who concluded that 96% of visitors to Block Island come from these states. Second, Block Island residents and people who own a second home on Block Island were not eligible for our survey, since residents may have an inherently different reaction towards wind farms from tourists (Ladenburg, 2010). Third, respondents were considered eligible if they had been to Block Island *at least once* since 2013. We believe that the people who have visited Block Island at least once constitute the relevant population because of several features and characteristics of the island that lend it a unique character with no close substitutes. Our choice of 2013 as the baseline year was motivated by a desire to have an even distribution of time before and after the turbines were constructed (construction began in August 2015 and was completed in August 2016).

A total of 319 respondents took the survey, out of which 265 people completed it. After eliminating two outliers[4] (0.8% of the observations), our final sample has 263 usable observations.

The survey consists of three parts. In the first part, we ask respondents questions about their trips to Block Island in the time period of 2013-2018. Respondents are asked about the average cost per trip for their most recent trip, and with whom they usually take the trip when visiting Block Island. They are

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[2] Provided by Qualtrics Panels, LLC, which outsources the data collection procedure to its partner companies with pre-existing consumer panels. This enables researchers to collect a desired number of responses based on their screening criteria.

[3] At the time we started our research, this was the only study done regarding tourist demographics at Block Island.

[4] Two respondents who reported a WTP over $10,000 are dropped from the sample.

also asked what recreational activities they had engaged in during each trip to Block Island.

The second part of our survey includes questions about the wind farm in Block Island shores.[5] Respondents are asked if they had seen the wind turbines *in person* during their visit(s). The respondents who had not seen the turbines were asked whether they had any knowledge of the Block Island wind farm *before taking the survey*. The respondents who had seen the turbines were asked whether they knew about the turbines before seeing them. Respondents who had seen the turbines are also asked about their reactions to seeing them (ranging from very positive to very negative), and what recreational activities they were engaged in while seeing them. For respondents who had not seen the turbines, these questions are modified to elicit hypothetical reactions as well. In this part, a picture of the five turbines at Block Island is shown to all respondents so that people who had never seen the turbines could have a visual representation for answering the questions that followed.[6]

The respondents are then asked to choose between two similar sites for each of five different activities (fishing, boating, sightseeing, beach recreation, or bird and whale watching),[7] the only difference being that one site has the view of the turbines and the other does not. Following this question, they are asked how much more they are willing to pay for their choice.[8] Should they have no clear preference between the sites, the respondents are given the option to remain neutral, which we interpret as a $0 WTP.

The third and final section of the survey includes basic demographic details such as age, household income and educational attainment. We also capture

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[5] To avoid introducing any biases in respondent perception, we take care to introduce the wind turbines in our survey using extremely neutral language: "There are some wind turbines in the ocean off the coast of Block Island (the Block Island Wind Farm)."

[6] Picture provided in Appendix. It is not a stock photograph taken from the internet and was captured by one of the authors of the paper themselves. We present the picture in its original form, and do not modify it in any way that could introduce positive or negative biases in respondents' perceptions.

[7] The choice of including these specific activities was based on feedback from focus groups and informal in-person interviews with several Block Island visitors.

[8] Actual questions included in the appendix.

respondents' environmental attitudes by incorporating questions from the New Environmental Paradigm (NEP) (Dunlap et al., 2000; Dunlap & Liere, 1978). We also have a comment box that allows respondents to communicate to researchers any suggestions or comments that may not have been captured anywhere else in our survey.

3.2 Data and Descriptive Statistics

The data from the survey can be grouped into three categories: 1) WTP values 2) Trip specific and 3) Demographics (Table 1). To elicit values for our first category, we first ask respondents to choose between two locations (for sightseeing, fishing, boating, beach visitation and bird/whale watching) that are similar in all attributes except that one location has a view of the wind farm while the other did not. They are then asked an open-ended WTP question for the site of their choice. If the respondents expressed a positive WTP for their choice of a location *without* a view of the turbines, they were assigned a negative WTP for a location *with* the turbine view. It is widely debated whether having a zero WTP is the same as being indifferent or having no preference between two options.[9] However, following Kriström (1997), we assume that the difference is subtle and define neutrality to be a zero value WTP in the analysis.

Table 1. Variable description

Variable	Description
WTP:	
Sightseeing	Respondent's WTP ($) for visiting a sightseeing location with a view of the wind farm.
Fishing	Respondent's WTP ($) for visiting a fishing location with a view of the wind farm.
Boating	Respondent's WTP ($) for a boating route with a view of the wind farm.

[9] About 5% of our sample chose a location with the turbine view but expressed a $0 WTP, and around 7% did the same for their choice of a site without the turbines.

Variable	Description
Beach	Respondent's WTP ($) for a beach location with a view of the wind farm.
Birding	Respondent's WTP ($) for a birding or whale watching site with a view of the wind farm.
Trip specific:	
Prior knowledge	Dummy indicating whether the respondent knew about the wind turbines prior to seeing them for the first time or before taking our survey.
Seen-in person	Dummy indicating whether the respondent has seen the wind turbines in person, during their visit to BI.
Cost per trip	The average cost of the most recent trip to Block Island (including transportation, lodging, meals, rentals, and any other expenses incurred on the island).
Repeat visitor	Dummy indicating whether the respondent took more than one trip to BI in the years 2013 – 2018.
Demographic:	
Income	Respondent's annual pre-tax household income in 2017, in $000's.
College	Dummy indicating whether the respondent has achieved college-level education or higher.
Age	Respondent's age.
Male	Dummy indicating whether the respondent is male.
Children	Dummy indicating whether the respondent has at least one child.
Environment	The respondent's environmental score based on six NEP questions. A higher number indicates a more pro-environment attitude.
Democrat	Dummy indicating whether the respondent is a Democrat.
Independent	Dummy indicating whether the respondent is an Independent.

We use a continuous, open-ended (OE) WTP elicitation technique over alternative discrete choice formats for three reasons. First, we follow the suggestion of Cummings et al. (1986) who recommend the use of the OE format in cases where the respondents are familiar with the good to be valued. In our sample, 67% of the respondents are repeat visitors who are familiar with Block Island and the locations in which the recreational activities might take place. Second, we do not use a discrete dichotomous choice question because a lack of empirical research on recreational impacts occurring from operational offshore wind projects (Smith et al., 2018) precludes us from providing a dollar value to the respondents against which they can compare their WTP's. Third, based on Monte Carlo results that compare an OE technique to a single binary choice design, Vossler & Holladay (2018) find suggestive evidence that smaller OE samples sizes can achieve the same level of precision in WTP as larger sample sizes using the single binary choice technique.

We have four variables in the 'Trip specific' category. The first is *Prior knowledge,* a dummy variable equal to one if an individual had prior knowledge about the turbines before seeing them for the first time or prior to taking our survey, and zero otherwise. The next variable is *Seen-in person,* an indicator for whether the respondents saw the wind turbines on Block Island.[10] The third is *Cost*, which is the log value of how much a person spends on an average trip to Block Island (including transportation, lodging, meals, rentals, and any other expenses incurred on the island). Finally, *Repeat visitor* is an indicator for whether a person took more than one trip to Block Island in the years 2013 - 2018.

Our final category includes demographic and socio-economic variables such as *Income* (a person's pre-tax household income in the year 2017) and *College*, an indicator for whether a respondent has obtained a bachelor's degree or higher. Demographic variables include *Age*, *Male*, and *Children*, where *Male* and *Children* are indicator variables equal to one if the respondent is male and has children, respectively. The attitudinal variable is *Environment* which is computed

[10] While some may find it surprising that there are people who visited Block Island after the turbines were built but did not see them, we know from focus groups (and even anecdotally) that it is indeed possible. The wind farm is located off the south-eastern coast of Block Island, and the hilly terrain of the island makes the turbines invisible from northern locations. The turbines are visible from the deck of the boat that ferries people to and from the island, but if one decides to sit below deck it is impossible to see them.

from the respondents' answers to the NEP questions. A higher number indicates more environmentally-friendly attitudes. Political covariates *Democrat* and *Independent* are indicator variables for whether a person is a Democrat or an Independent, respectively, with Republican being the omitted category.

Summary statistics are given in Table 2. A majority of the respondents (67%) are repeat visitors. Only 37% of the people had prior knowledge of the turbines prior to seeing them for the first time in person or before taking the survey, though 68% (of the total sample) have seen them during their trip. The subjects have an almost equal distribution of males and females. A little over half of our sample population (58%) have obtained a bachelor's degree or higher. They are generally middle-aged, with 41 years being the mean age. The respondents in the sample have an average annual income of $77,300 and usually spend nearly $900 on a trip to Block Island. Our sample is politically skewed towards Democrats (44%), with the remaining being almost evenly split between Republicans (25%) and Independents (30%).

Table 2. Summary statistics

Variable	Mean	SD	Min	Max
WTP ($):				
Sightseeing	27.12	130.45	-600	1000
Fishing	22.20	105.63	-600	600
Boating	20.97	98.20	-450	800
Beach	19.29	79.31	-210	600
Birding	11.92	75.38	-500	500
Trip specific:				
Prior knowledge	0.37	0.48	0	1
Seen-in person	0.68	0.47	0	1
Cost per trip ($)	876.32	1239.13	10	10,000

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Variable	Mean	SD	Min	Max
Repeat visitor	0.67	0.47	0	1
Demographic:				
Income ($1000)	77.30	44.67	10	175
College	0.58	0.49	0	1
Age	40.79	14.22	21	80
Male	0.50	0.50	0	1
Children	0.54	0.50	0	1
Environment	22.66	4.28	8	36
Democrat	0.44	0.50	0	1
Independent	0.30	0.46	0	1

Note: N = 263 for all variables.

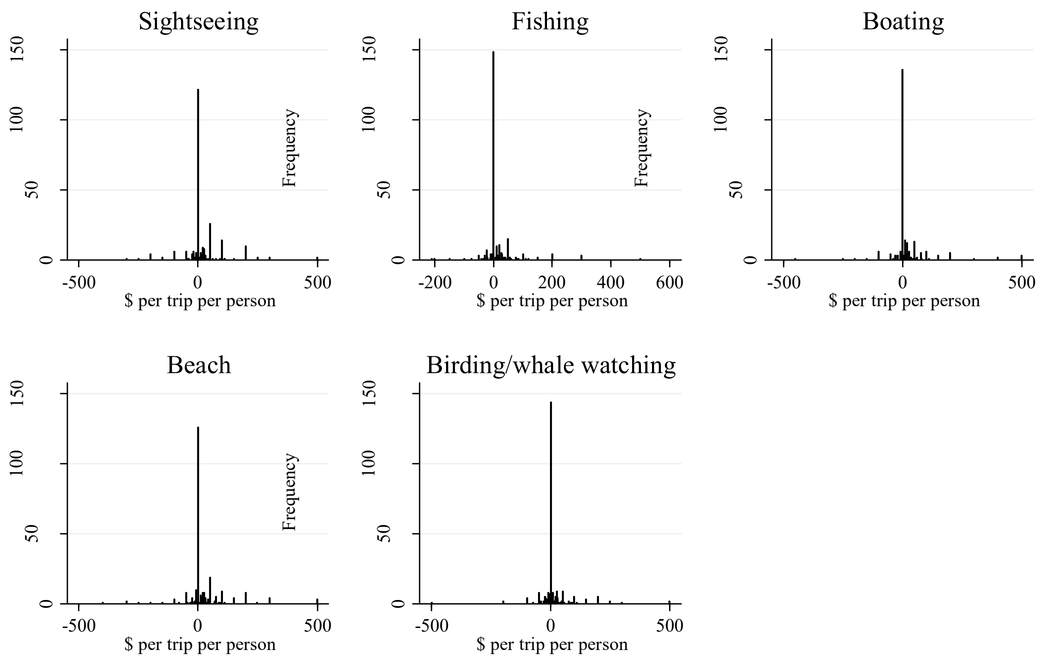
3.2.1. Distribution of Willingness to Pay, With and Without, Turbine Presence

Figure 1 shows the activity specific distribution of the WTP variables.[11] The mean WTP is always positive and ranges between $11.92 (for birding/whale watching) to $27.12 (for sightseeing). The spike at $0 is consistent with our expectation of people being either mostly neutral or unwilling to pay anything for their choice.[12] However, there is heterogeneity by type of activity since some respondents report choosing different locations depending on the activity. About

[11] The frequency distribution of willingness to pay by activity (in percentage terms) is given in Table A.3 of the appendix.

[12] We check for protest zeros by looking at the consistency between people's responses to the survey questions and their comments at the end of the survey. Approximately 25% of the respondents (66 of the 263) left comments, none of which implied protest values.

32.70% of the total population are indifferent in each of the five activities, whereas 5.70% always prefer a location with a view of the turbines, and 19.39% always prefer locations without a view. The remaining 42.21% of the sample population exhibit variation in their location preferences depending on the activity.



Note: The x-axis is trimmed at -500 and 500 to facilitate visual interpretation. This dropped four observations for fishing, five for birding/whale watching, six for boating, and seven for sightseeing and beach.

Figure 1. Distribution of the respondents' Willingness to Pay with and without the view of the turbines for different activities.

3.2.2. Prior Knowledge of Turbines

We analyze the impact of the wind farm on the number of trips taken to Block Island by comparing the average number of trips taken by all respondents between two groups: those who had prior knowledge about the wind turbines before seeing them for the first time or before taking our survey (*Prior knowledge* = 1), and those who did not (*Prior knowledge = 0*). From Figure 2, we can see

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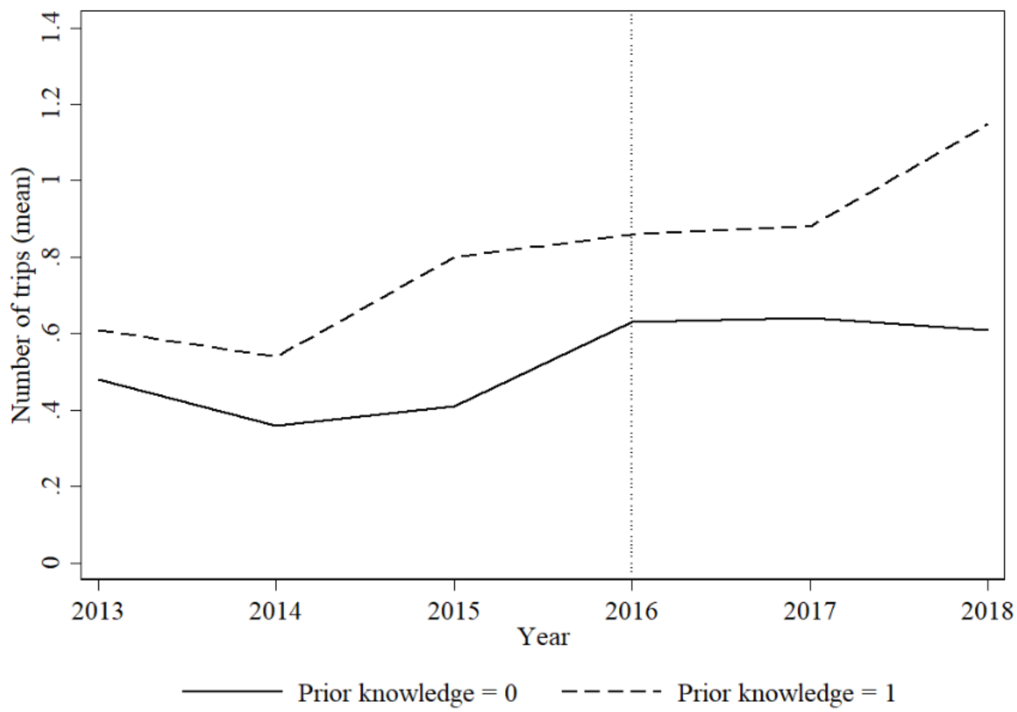
that both groups exhibit similar trends in the average number of trips taken per year across years until 2017. However, from 2017 to 2018, we see that the mean number of trips increases for the *Prior knowledge* = 1 group but not for the *Prior knowledge* = 0 group.[13] Overall, the figures suggests a positive effect of prior knowledge on visitation after construction.



Note: 2016 was the year of turbine construction. The mean number of trips for 2018 is scaled up by 12/8 since the survey was disseminated in August. The sample size is 263.

Figure 2. Number of trips taken to Block Island by two categories of respondents: with and without prior knowledge of the wind turbines (2013 – 2018).

[13] We conduct a t-test and find that this difference in means is statistically significant at the 1% level. Since the respondents took the survey in August 2018, we scale the means by 1.5 (12 months/8 months = 1.5) to account for potential trips in the remaining months of that year.

4. DETERMINANTS OF WTP

4.1. Econometric Model

To analyze the impact of the prior knowledge and sight of the Block Island wind farm on the respondents' WTP for different activities and locations, we evaluate their WTP for five major activities: sightseeing, fishing, boating, beach visitation and bird/whale watching. We use Ordinary Least Squares (OLS) estimation to evaluate the respondents' WTP for these activities at locations with a view of the wind turbines. Our specification is:

$$\begin{aligned} WTP_i = \beta_0 &+ \beta_1 Prior\ knowledge_i + \beta_2 Seen{-}in\ person_i + \beta_3 Cost_i \\ &+ \beta_4 Repeat\ visitor_i + \beta_5 Income_i + \beta_6 College_i + \beta_7 Age_i \\ &+ \beta_8 Male_i + \beta_9 Children_i + \beta_{10} Environment_i \\ &+ +\beta_{11} Democrat_i + \beta_{12} Independent_i + \epsilon_i \end{aligned}$$

where WTP_i is individual $i's$ WTP for their chosen wind farm experience across five different recreational activities, and ϵ_i is the error term. The covariates are as described in Section 3.1. We also use state fixed effects to control for unobserved heterogeneity across states and report Huber-White standard errors clustered at the state level to account for heteroskedasticity and autocorrelation.[14]

4.2. Regression Results

The regression results for the WTP-turbine specification (Table 3) reveal that prior knowledge about wind energy at Block Island has a positive and statistically significant (at the 5% significance level) effect only on WTP to visit a beach. On average, respondents who had prior knowledge about the wind farm's existence are willing to pay $34.09 more for beaches with a view of the turbines, as compared to the respondents who did not have prior knowledge.

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[14] We also estimate a multinomial logit model where the dependent variable is categorical (positive WTP, zero WTP, negative WTP). The results from that specification are qualitatively similar but are underpowered. Results can be provided upon request.

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Table 3. Determinants Of Willingness To Pay For Activities.

Independent variables	Dependent variable: WTP				
	Sightseeing	Fishing	Boating	Beach	Birding
Prior knowledge (1 = Yes)	23.58	3.72	2.54	34.09**	14.44
	(15.96)	(9.17)	(10.48)	(11.37)	(11.48)
Seen-in person (1 = Yes)	3.99	9.47*	20.91**	4.52	8.51
	(10.49)	(4.80)	(7.03)	(16.55)	(5.39)
Log cost per trip	2.37	2.32	3.43	4.52	-3.71
	(4.98)	(3.12)	(2.72)	(5.05)	(2.24)
Repeat visitor (1 = Yes)	51.58***	20.58***	11.89*	31.70**	14.38***
	(15.81)	(5.58)	(6.03)	(13.90)	(4.12)
Income ($1000)	0.05	0.07	-0.09	-0.14	0.02
	(0.29)	(0.12)	(0.22)	(0.22)	(0.15)
College (1 = College graduate or above)	-12.67	-12.48	0.14	-21.51	-0.87
	(13.60)	(15.55)	(18.74)	(13.41)	(8.83)
Age	-0.52	-0.28	-0.40	-0.44	-0.46**
	(0.44)	(0.25)	(0.36)	(0.32)	(0.16)
Male (1 = Yes)	26.62*	11.63	32.79***	14.37	9.84
	(13.89)	(10.19)	(6.79)	(9.02)	(6.54)

Independent variables	Dependent variable: WTP				
	Sightseeing	Fishing	Boating	Beach	Birding
Children (1 = Yes)	4.57	16.67	12.06	8.04	20.23***
	(17.79)	(14.64)	(13.97)	(19.47)	(4.55)
Environment	-2.22	-0.67	-0.18	-1.96	-0.47
	(1.51)	(1.16)	(0.93)	(1.08)	(0.90)
Democrat (1 = Yes)	11.30	-3.65	-1.50	-1.32	-3.83
	(19.72)	(16.34)	(17.25)	(8.26)	(9.80)
Independent (1 = Yes)	-11.70	-24.32	-30.21*	-15.25	-19.36**
	(22.10)	(15.86)	(13.56)	(12.14)	(7.97)
Observations	263	263	263	263	263
R-squared	0.12	0.11	0.11	0.13	0.08

Note: All models include state fixed effects. Robust standard errors (clustered at the state level) are shown in parentheses. *, **, and *** indicate significance at 10%, 5% and 1%, respectively.

The impact of having seen the turbines in person on WTP is positive and statistically significant for fishing and boating, with respondents willing to pay $20.91 more for a boating route and $9.47 for a fishing location with a view of the turbines than without one. This finding conflicts with the stated preference studies that find wind farms to be a visual disamenity in other contexts (Bishop & Miller, 2007; Firestone, et al., 2018; Fooks et al., 2017; Krueger et al., 2011b; Ladenburg, 2009; Ladenburg & Dubgaard, 2007; Landry et al., 2012a; Lilley et al., 2010a), but is consistent with evidence from Block Island in particular. Since turbine construction, ferries and charter boats have added trip options to see the turbines up close and the wind farm is a popular option for recreational fishing (Smythe et al., 2018; Tenbrink & Dalton, 2018). The ferries and charter boats charge about $30 for a trip to the wind farm (Charters, n.d.; Ferry, n.d.). The third trip-specific variable, *Cost*, is insignificant throughout.

Repeat visitor is positive and significant at 10% for fishing, 5% for the beach activity, and at 1% for all the others. This implies that compared to one-time visitors, repeat visitors are willing to pay between $12 - $52 more, on average, for locations with a view of the turbines. The positive sign for this variable is contrary to Ladenburg & Dubgaard's (2009) findings that frequent users of the coastal areas, specifically boaters and anglers, are generally more averse to wind farms. However, according to more recent research by Tenbrink & Dalton (2018) and Smythe et al. (2018), the base of the turbines has served as an artificial reef for spearfishing, which can explain the positive WTP for fishing and boating in our specification. Additionally, frequent visitors may perceive the construction of the wind farm as a novel feature of their repeat recreational site. Tourism is a competitive market and novelty is an important predictor to not only attract new visitors, but also retain repeat visitors (Assaker et al., 2011). Studies on recreational choice behavior have found evidence of variety seeking behavior when choosing sites for recreation (Adamowicz, 1994; Astrid D. A. M. Kemperman, 2000; Borgers et al., 1989). It is also possible that repeat visitors are more familiar with the use of diesel fuel as a primary energy source on Block Island prior to the construction of the wind farm. We speculate that the switch to a cleaner source of energy could be a motivator for an increased WTP for these repeat visitors.

Demographic variables appear to exhibit either a null, or a very weak effect on WTP across the board. *Income* and *College* are insignificant throughout. The coefficient for *Age* is negative and significant at 5% for the Birding/Whale watching model, though its magnitude is very small. On average, men are willing to pay more than women across all activities, though the coefficient is significant only for Sightseeing (10%) and Boating (1%). Male respondents are willing to pay $32.79 more as compared to female respondents for boating routes, and $26.62 more for sightseeing locations with the view of the turbines. Having children positively impacts respondents' WTP only for the Birding/Whale watching model, with respondents willing to pay $20.23 more for that activity at locations with a view of the turbines. The variable for attitude, *Environment,* is not significant for any of the activities.

We find no evidence of differences in WTP by partisanship. Democrats do not have a significantly different willingness to pay for a view of the wind farm than Republicans. At first blush, this result is surprising given the partisan differences in opinions about the importance of addressing climate change (Pew Research Center, 2010) and in voting on environmental referendums (Altonji et al., 2016; Holian & Kahn, 2015). However, this result is consistent with research specific to the Block Island Wind Farm that finds that a majority of both Democrats and Republicans support the wind farm on Block Island (Sokoloski et al., 2018). The coefficients for *Independent* are significant only in the models for boating (at 10%) and bird/whale watching (at 5%), though the sign is negative. This implies that independents prefer boating and bird/whale watching locations *without a view of the wind farms*.

To summarize, we see no negative impacts of the wind farm on any recreational activity, and we see a positive WTP by frequent visitors to the island, and for fishing, boating, and beach activities. This is an important finding since tourism is a vital part of Block Island revenues, and initially, there was a concern about the potential negative impacts the turbines might have on tourists' experience of the island.

Regarding the comparability of our estimates, Ladenburg & Dubgaard (2009) is the closest study to our own that looks at WTP values across different recreational activities around wind farms. However, their estimates are not directly comparable to our own for two key reasons. First, their sample represents a Danish population, which is systematically different from the U.S. population. Second, their estimates represent WTP to relocate the wind farms to distances further away than eight kilometers away from the coast, whereas ours are simply for their presence.

5. CONCLUSION

This paper examines the valuation of offshore wind turbines in Block Island, RI, the first offshore wind energy farm in the U.S. We use data from an original survey of 263 US residents who have been to Block Island at least once in the time period of 2013 – 2018. In our study, we do not find a significant negative impact of prior knowledge or views of the turbines on the average number of trips or WTP. The average number of trips remains unaffected by the prior knowledge of the turbines. Instead, respondents show a positive attitude to the offshore wind turbines overall as well as in terms of their effects on specific recreational

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activity. The estimated average WTP is positive across all activities, suggesting that the overall welfare of tourists has improved with construction.

This study also finds positive effects of prior knowledge on WTP for beach locations with a view of the turbines. We find that respondents with prior knowledge of the turbines are willing to pay, on average, $34 more for a view of the wind farm while enjoying the beach. With approximately 596,200 annual visitors to Block Island, the presence of prior knowledge would account for an increase of over 20 USD in tourism-generated revenues.[15] This substantial value addition from creating awareness has important implications when siting new renewable energy projects.

Previous literature has found that offshore wind farms are visual disamenities, especially when they are closer to shore (Firestone et al., 2018; Fooks et al., 2017; Krueger et al., 2011b; Landry et al., 2012a; Lilley et al., 2010a). However, the Block Island wind farm is only 3.8 miles from the shore, and yet our study does not find proof of significant visual disamenity. We find a positive association between the WTP variable and having seen the turbines for fishing and boating activities. One of the reasons for our findings can be the small number of turbines erected off Block Island (five in total). Another reason can be the novelty of this wind farm. Being the first offshore wind development in the United States confers this farm a unique, historical status that attracts tourists and encourages them to take "curiosity trips" to check-out the new construction (Parsons & Firestone, 2018). It can also attract repeat visitors to the site, who may be looking for a change in scenery. The consistent positive impact on repeat visitors' WTP for activities at locations with a view of the turbine supports this theory. There is evidence suggesting a positive impact on tourism and tourist activities from wind farms in general (Firestone et al., 2008; Frantál & Kunc, 2011; Frantál & Urbánková, 2017), and the Block Island wind farm in particular (Carr-Harris & Lang, 2019). Finally, since we consider only tourists in our sample (Block Island is home to barely 1000 full-time residents, and fewer still are proximate to the wind farm), our positive WTP results may be reflecting the general support towards renewable energy in the United States (Bates & Firestone, 2015; Farhar, 1994; Firestone, Bidwell, et al., 2018a; Hoen et al., 2019; Krohn & Damborg, 1999).

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[15] 596,200 x $34 = $20,270,800

Several states on the East Coast of the United States have ambitious goals of considerably increasing the percentage of clean, renewable energy in their power mix. Upcoming projects are slated to install several large-scale offshore wind farms along the coast to meet these states' clean energy goals. The wind farm project off the coast of Martha's Vineyard is an 84-turbine project with the proposed turbines being 14 miles from the shore (M. P. Norton, 2019). While these turbines will be further away from the coast when compared to the ones at Block Island, the size of the turbines and the scale of the project render the Block Island wind farm a less intrusive structure. Future studies can look into potential trade-off between the number of turbines and turbines' proximity to shore once the Martha's Vineyard project is completed. The estimates in our study are based on actual views (as opposed to hypothetical views), and a similar post-construction study of the upcoming turbines off the coast of Martha's Vineyard would contribute to our understanding of how tourist's engagement in recreational activities changes because of different specifications of scale and proximity of the project to the shore. The substantial value added as tourism generated revenue due to the Block Island wind farm indicates the importance of including tourists' along with residents' preferences in the future decisions making process for offshore wind farm siting.

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APPENDIX

A.1. Picture of the Wind Turbines as Visible from the Southern Shore of Block Island:

A.2. Survey Questions on Willingness To Pay for Recreational Activities:

1) Given the choice between two **sightseeing locations** on Block Island (such as the lighthouse), one with a view of the wind turbines and one without, that otherwise have identical features, which one would you prefer?
2) Given the choice between two **identical beach locations** on Block Island to use for recreational purposes, one with a view of the wind turbines and one without, which one do you prefer?

3) Given the choice between two **similar boating routes** to go to a destination on Block Island, one with a view of the wind turbines and one without, which one do you prefer?
4) Given the choice between two similar **offshore fishing routes** on Block Island, one with a view of the wind turbines and one without, which one do you prefer?
5) Given the choice between two similar **bird/whale watching sites** on Block Island, one with a view of the wind turbines and one without, which one do you prefer?

All the five recreational preference questions had the following answer choices:

a) the location with the view of wind turbines
b) the location without the view of wind turbines
c) no preference.

If the respondent answered a) or b) in any of the five recreation questions, they were redirected to the following question:

Q) How much are you willing to pay **extra** to get *{Your Choice}?* (in US $/trip/person) [Note: We are not asking how much you are willing to pay for the route in total]

Here, the *"{Your Choice}"* term was populated with the respondent's chosen answer (a: the location with the view of wind turbines; or b) the location without the view of wind turbines) from the previous question.

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A.3. Frequency Distribution of Willingness To Pay by Activity

Table A.3. Frequency distribution of willingness to pay by activity

	Sightseeing	**Fishing**	**Boating**	**Beach**	**Birding**
Less than -$50	8%	3%	5%	7%	6%
-$50 to -$1	8%	10%	8%	10%	13%
$0	46%	56%	51%	47%	55%
$1 to $50	23%	22%	24%	21%	17%
$51 to $100	6%	4%	6%	7%	4%
$101 to $250	6%	3%	3%	5%	4%
$250 to $500	2%	2%	2%	3%	1%
Greater than $500	1%	1%	0%	0%	0%

Notes: The percentages are calculated based on a total of 263 observations per activity.

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